The readability of online patient information about laser resurfacing therapy

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Abstract

Because there are important distinctions between ablative and non-ablative laser resurfacing, accurate and effective patient education is paramount. However, as more patients use the internet as a resource for medical information, little is known about the content and readability of these sources. Thus, we sought to evaluate the readability of major online resources about laser resurfacing while recognizing the recommendations by the American Medical Association and National Institutes of Health. An internet search for the term "Laser Resurfacing" was performed. The first 9 results were identified, patient information from each of these 9 sites were downloaded, and a total of 25 articles were examined. Readability was analyzed using 7 different established tests. Analysis demonstrated an average grade level of at least 9th grade, with all articles exceeding the recommended 6th grade reading level, emphasizing that these resources are too challenging for many patients to read and comprehend. Such materials may hamper appropriate decision-making in patients considering the use of a laser for their dermatologic conditions. The potential detrimental effect on the opinion, participation, and satisfaction of laser resurfacing should spur dermatologists to be more critical of online patient materials and motivated to produce more appropriate resources.

Keywords: readability, laser resurfacing, ablative, non-ablative, patient information

Introduction

Since its introduction in the 1980s, laser rejuvenation has evolved into a precisely controlled procedure to treat myriad cutaneous conditions, including photo and chronological aging and acne scarring, among others [1]. The types of resurfacing options available to patients are numerous, primarily categorized as either ablative or non-ablative lasers.

Ablative techniques employ either CO_2 or erbium to remove the epidermis and upper dermal layers to induce a wound response that results in the growth of new skin [2]. Using water as its main chromophore, the CO_2 laser emits light in the infrared spectrum at 10,600nm [3]. CO_2 laser-induced tissue destruction typically extends 200 to 300μm into the dermis, prompting a predictable skin tightening effect through the shrinkage of collagen and initiation of new collagen formation [4]. The erbium:yttrium-aluminium-garnet (Er:YAG) laser delivers at 2,940nm and is ten times better absorbed than the CO_2 laser by water. This results in ablation with much less collateral heating and reduced dermal collagen contraction and remodeling [4]. When fractionated, both these lasers induce multiple tiny columns of vaporized tissue [3]. Traditional full field ablative laser surgery remains the gold standard for laser rejuvenation, yet it can be associated with prolonged post-operative healing, unwanted pigmentation changes, and scarring [5].

Non-ablative fractional lasers improve the structure and appearance of the skin without disturbing epidermal integrity [6]. Characteristically, these devices present spatially separated micro-beams across the skin surface to create microscopic treatment zones of non-ablative thermal injury [7]. The depth and degree of dermal tissue damage depends on pre-determined factors such as wavelength, pulse energy, and density [7]. Non-ablative resurfacing can be associated with less significant side effects and downtime when compared to ablative techniques [8].

Table 1. *Laser Resurfacing Websites. Table listing the websites analyzed in this study and their respective organizations. Some websites included more than one easily accessible article. An easily accessible article was defined as an article reached through no more than one click from the initial website page.*

Website	Organization	Sponsor Type	Number of Articles
asds.net	American Society for Dermatologic Surgery	Medical Society	7
medicinenet.com	MedicineNet, Inc.	Online Resource	1
webmd.com	WebMD	Online Resource	1
americanboardcosmeticsurgery.org	American Board of Cosmetic Surgery	Medical Society	1
plasticsurgery.org	American Society of Plastic Surgeons	Medical Society	7
mayoclinic.org	Mayo Clinic	Academic	1
healthline.com	Healthline Media	Online Resource	1
ucsf.edu	UCSF	Academic	1
stanford.edu	Stanford	Academic	5
Total			25

Accurate and effective patient education is paramount because there are important distinctions between these laser choices. It is well established that patients who are well-informed have increased satisfaction and overall better health outcomes, emphasizing the importance of quality patient education [9, 10]. A 2012 survey by the National Cancer Institute found that 78% of US adults had internet access and 70% of this group used the internet as their initial source of health information [11]. The internet provides access to health information (some accurate, some false) immediately in the privacy of the patients' own homes, a reason that explains the shift to the increasing popularity of web-based medical information [12].

As more patients use the internet as a resource for medical information, little is known about the complexity of content and readability of the sources they are consuming. Thus, a consideration of health literacy, defined as the degree to which an individual has the capacity to obtain, communicate, process, and understand basic health information, is essential for ensuring patients can make appropriate health decisions [10]. The American Medical Association (AMA) and National Institutes of Health (NIH) currently recommend the reading level for patient educational materials to not exceed sixth grade [13]. In spite of these recommendations, several studies have shown that current patient education materials are too complex for the average population and exceed the recommended reading levels set forth by the AMA and NIH [14–16].

This original, cross-sectional based study evaluates the readability of online patient information about laser resurfacing in the context of AMA and NIH recommendations. Currently, there have been no studies exploring the readability of online patient information regarding laser resurfacing and limited studies regarding readability in dermatologic topics in general [17].

Methods

A web search was performed on the Google search engine for the term "laser resurfacing," and the top nine non-sponsored sites were identified. The term "laser resurfacing" was chosen as it provided broad results encompassing both ablative and non-ablative resurfacing techniques. Alternative phrases were considered but ultimately eliminated as they either: a) provided results too specific for the intended scope of this study (e.g., "ablative laser", "non-ablative laser", "fractional laser") or b) provided results meant for commercial purposes instead of informational use (e.g., brand names such as "Fraxel laser").

Location data, user account information, and cookies were disabled to avoid inadvertent bias in the websites generated. Individual web sites were accessed from the search result link, with the top nine hits as followed: asds.net, medicinenet.com,

Table 2. *Table 2: Tests of Readability Table listing the Tests of Readability employed in the study. The score type, qualities assessed, algorithmic format, and algorithmic formula are included.*

Test	Score Type	Qualities Assessed	Format	Formula
Flesch-Reading Ease	Index Score (Range: 0-100, Easiest = 100)	Word Complexity, Sentence Length	Formula, Graph	Ease = 206.835 – (1.015 x ASL) – (84.6 x ASW)
Flesch-Kincaid	Grade Level	Word Complexity, Sentence length	Formula	G = (0.39 x ASL) + (11.8 x ASW) - 15.59
Gunning Fog	Grade Level	Word Complexity, Sentence length	Formula	G = 0.4 (ASL + PHW)
Coleman-Liau	Grade Level	Word Length, Sentence length	Formula	G = 0.0588L – 0.296S – 15.8
SMOG	Grade Level	Word Complexity, Sentence length	Formula	G = 1.0430 · √HW + 3.1291
Automated Readability Index	Grade Level	Word Complexity, Sentence length	Formula	G = 4.71 (characters/words) + 0.5 (words/sentences) – 21.43
Linseare Write Formula	Grade Level	Word Complexity, Sentence length	Formula	1. Find 100 word sample 2. X = (EW*1+HW*3)/number of sentences. 3a. If X is >20, divide by 2. This is the grade level. 3b. If X ≤ 20, subtract 2, then divide by 2. This is the grade level.

webmd.com, americanboardcosmeticsurgery.org, plasticsurgery.org, mayoclinic.org, healthline.com, ucsf.edu, stanford.edu. From each website, the initial article displayed upon clicking the search result link and all easily accessible articles were evaluated for readability. An easily accessible article was defined as an article reached through no more than one click from the initial website page (**Table 1**). Each article was downloaded directly from the original parent site and formatted into plain text in a separate Microsoft Word 2017 document. All articles were accessed on November 17th, 2018. Prior to performing readability analysis, special characters, links, advertisements, references, and figures/figure captions were removed.

Twenty-five total articles were downloaded, organized by website, and analyzed using readability software. Readability assessment was performed using Readability-Score.com. Seven established readability tests were utilized: Flesch-Reading Ease, Flesch-Kincaid Reading Level, Gunning Fog Score, Coleman-Liau Index, SMOG (Simple Measure of Gobbledygook) Index, Automated Readability Index, and Linseare Write Formula (**Table 2**). Primary analysis included all articles from all sites. Secondary analysis was performed after grouping articles separately by parent website. Statistical analysis was performed using Microsoft Excel 2017 (Microsoft Corp., Redmond, WA).

Table 3. Laser Resurfacing Websites Reading Grade Level by Website Sponsor Type. Website Sponsor Type is classified in **Table 1**.

Test of Readability	Medical Society	Academic	Online Resource	Total
Gunning Fog	13.2	12.8	11.8	12.6
Flesch-Kincaid	10.9	9.8	9.4	10.0
Coleman-Liau	12.0	11.6	10.7	11.4
SMOG	9.9	9.5	8.9	9.4
Automated Readability Index	11.3	9.7	9.3	10.1
Linseare Write Formula	11.6	9.7	9.6	10.3
Average	11.5	10.5	9.9	10.6

Results

Primary readability analysis of 25 articles spanning 9 different sites demonstrated a mean reading grade level of 10.6 for laser resurfacing websites. When organized by website sponsor type (medical society, academic, online resource; defined in **Table 1**), the average grade level for medical society websites was 11.5, for academic websites was 10.5, and for online resources was 9.9 (**Table 3**).

When secondary analysis was performed for articles grouped by parent website, all parent websites exceeded the recommended sixth-grade reading level in all applicable readability scores (**Figure 1**). Flesch-Kincaid Reading Ease, a score that does not provide a grade level but instead classifies reading ease with a qualitative designation depending on the range of score, did not classify any parent website easier than "fairly difficult" (**Figure 2**). Average overall grade level by parent website revealed a minimum of 9.6 (webmd.com) and maximum of 12.2 (americanboardcosmeticsurgery.org), (mean 10.6, standard deviation 0.88), (**Figure 3**). Average overall grade level by readability score revealed a minimum of 9.43 (SMOG) and maximum of 12.58 (Gunning Fog), (mean 10.6, standard deviation 1.15), (**Figure 4**).

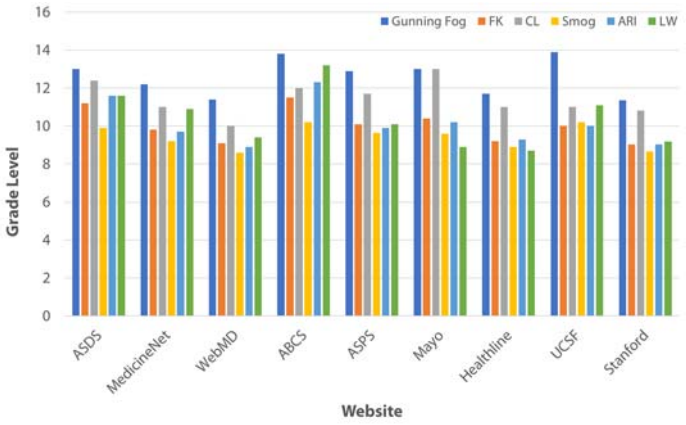

Figure 1. *Comprehensive readability analysis by Web Site. Calculated reading grade levels for each web site using six different numeric readability scores are shown. Dashed line indicates the AMA and NIH-recommended target reading level. FK, Flesch-Kincaid Reading Level; CL, Coleman-Liau Index; SMOG, Simple Measure of Gobbledygook Index; ARI, Automated Readability Index; LW, Linseare Write Formula; ASDS, American Society for Dermatologic Surgery; ABCS, American Board of Cosmetic Surgery; ASPS, American Society of Plastic Surgeons; AMA, American Medical Association; NIH, National Institutes of Health.*

Discussion

Our Google search engine query results for laser resurfacing patient education materials found 25 articles from the top 9 websites, with an average reading grade level of 10.6. All 25 articles had an average readability score above the sixth-grade level, the maximum level recommended by the AMA and NIH, and thus likely contained information too difficult for the majority of patients to comprehend. To our knowledge, this is the first study to assess the reading level of online information for laser resurfacing patient education materials.

From the initial search, the website sponsor type of three parent sites were classified as medical society, academic institution, and online resource. When using sponsor type as the instruction for grouping, medical society-based resources were rated the most difficult (11.5 grade level). Specifically, the most difficult rated parent site was americanboardcosmeticsurgery.org (medical society), whereas the least difficult rated parent site was webmd.com (online resource). Of note, the first, or most popular, website found on our query was

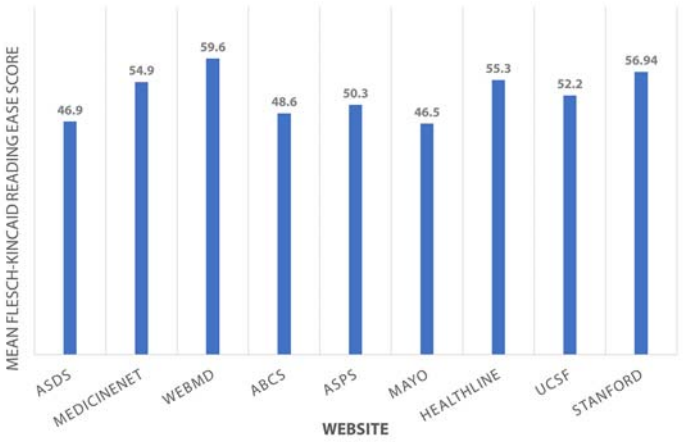

Figure 2. *Flesch-Kincaid Reading Ease by Website. The Flesch-Kincaid Reading Ease is classified as follows. 0-30 (very difficult), 30-50 (difficult), 50-60 (fairly difficult), 60-70 (standard), 70-80 (fairly easy), 80-90 (easy), 90-100 (very easy). No websites regarding laser resurfacing were rated easier than fairly difficult. ASDS, American Society for Dermatologic Surgery, ABCS, American Board of Cosmetic Surgery; ASPS, American Society of Plastic Surgeons.*

asds.net (medical society, average grade level: 11.6). Medicinenet.com and webmd.com, both online resources, were the second and third most popular sites respectively.

When comparing the average reading grade level of each website to the AMA and NIH recommended level, websites on laser resurfacing exceeded the recommendation by an average of 4.6 grade levels. The need for understandable, appropriately constructed online information about laser resurfacing is of importance when considering the common applications of the procedure. Given its cosmetic focus, laser resurfacing is likely associated with significant pre-procedure patient anxiety, a feeling that patients hope to alleviate after thorough online research [18]. However, with online patient information too complex for the majority of patients, proactive efforts to learn about the procedure and reduce apprehension may result in an opposite effect.

With many physicians overestimating the literacy skills of their patients, it is necessary to appreciate the implications of easily available, aptly created online information about laser resurfacing [19]. Appropriate educational materials can more effectively manage patient's expectations, preconceptions, and fears, subsequently improving a patient's perception of the outcome [20]. Better informed patients will more likely have a genuine interest in the procedure.

Appropriate online information is of high demand. Sixty two percent of patients who use the internet for personal health information want their physicians to recommend specific web sites that they would consider instructive and reliable [21]. When directing patients to these web sites, it is important for physicians to be knowledgeable about the suitability and readability of their recommendations, as providing effective informational resources to patients may decrease medical liability [22].

The medically related consequences of more appropriate online resources leading to improved health literacy are profound. In the past, certain demographic characteristics have been strong predictors of internet use, including having a college degree, being white, being employed, and having a high household income [23, 24]. However, as more of the population gains access to the internet (76.2% of the American population accessed in the internet in 2016), a growing number of people with a lower level of health literacy are utilizing this as their first line for health information [25, 26]. Patients with a low level of literacy are 1.5 to 3 times more likely to experience a poor outcome after a procedure, in part related to a poor understanding of health resources [27]. Consequently, an effort to create online information that is more accessible to the increased user

Figure 3. *Average Grade Level by Website. The mean grade level (from 6 different readability tests) exceeded the AMA and NIH-recommended 6th grade level for all websites. ASDS, American Society for Dermatologic Surgery; ABCS, American Board of Cosmetic Surgery; ASPS, American Society of Plastic Surgeons; AMA, American Medical Association; NIH, National Institutes of Health.*

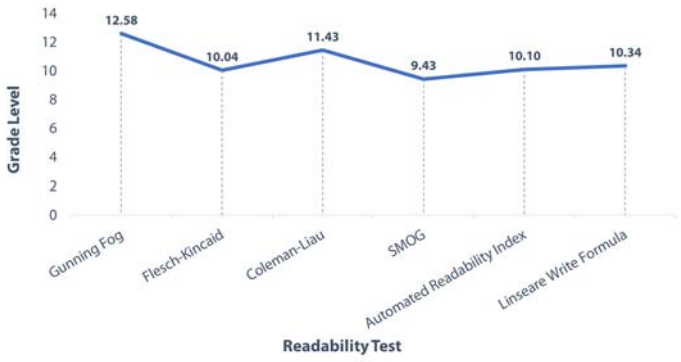

Figure 4. *Average Grade Level by Readability Test. The mean grade level (from 9 different websites tests) exceeded the AMA and NIH-recommended 6th grade level for each readability algorithm. SMOG, Simple Measure of Gobbledygook Index; AMA, American Medical Association; NIH, National Institutes of Health.*

population may not only improve patient outcomes and satisfaction, but may also help serve to improve health disparities [26, 28].

Improving the readability of patient education materials can be achieved through utilizing simpler terms, shorter sentences, numerous figures, and visual aids [29]. Additionally, recognizing patients at risk for low health literacy through brief screening questions can be effective in choosing personalized resources and initiating additional interventions [30]. "Teach back" methods have been validated as successful ways to assess patient understanding of material recently presented [31]. With informed consent being the number one reason for litigation associated with common dermatological procedures, dermatologists may wish to spend additional time counseling patients preoperatively [32].

This study has several possible limitations. Employing strict formulae to assess the readability of patient information does not account for patients' knowledge or their motivation to understand the subject; a patient with normally low-health literacy may devote great time and effort to develop an advanced understanding of a recommended procedure. Similarly, the readers consuming information about laser resurfacing may not be representative of the general population. Cosmetic patients in particular may have a reading level more advanced than those of the general population. Recent study into the educational background of cosmetic surgery patients found that around 67% had a college degree, versus about 33% in the general United States population [33]. Furthermore, the supplemental aspects of the web sites included (i.e. videos, figures, tables, and diagrams) were not analyzed. Lastly, our search was composed of only English language articles. As the demographic of the United States shifts over time to include an increasing number of non-native English speakers, efforts should be made to assess the readability of Spanish language online patient information [34].

Conclusion

Online information available for laser resurfacing exceeds the AMA and NIH recommended reading level, emphasizing that these resources are too challenging for many patients to read and comprehend. Such materials may prevent appropriate decision-making in patients considering the use of laser resurfacing for their dermatologic conditions and negatively impact perception of the use of lasers whatsoever. The potential detrimental effect on the opinion, participation, and satisfaction of laser resurfacing should spur dermatologists to be more critical of online patient materials and be motivated to produce more suitable resources.

Potential conflicts of interest

The authors declare no conflicts of interests.

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